

12.7 Cylindrical and Spherical Coordinates

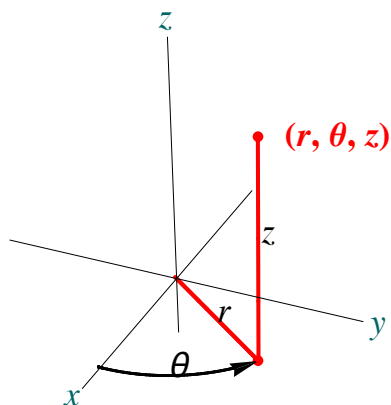
Cylindrical Coordinates

Cylindrical coordinates are written (r, θ, z) , and the conversion to rectangular coordinates (x, y, z) is

$$x = r\cos(\theta) \quad y = r\sin(\theta) \quad z = z$$

Converting from rectangular to cylindrical use

$$x^2 + y^2 = r^2 \quad \tan(\theta) = \frac{y}{x} \quad z = z$$



Example 1 Plot the point with cylindrical coordinates $(4, \frac{5\pi}{3}, 6)$ and write the point in rectangular coordinates.

Example 2 Describe the cylindrical constant equations: $r = k$, $\theta = k$, $z = k$.

Example 3 Describe the graph of $z = r$, and rewrite it in rectangular coordinates.

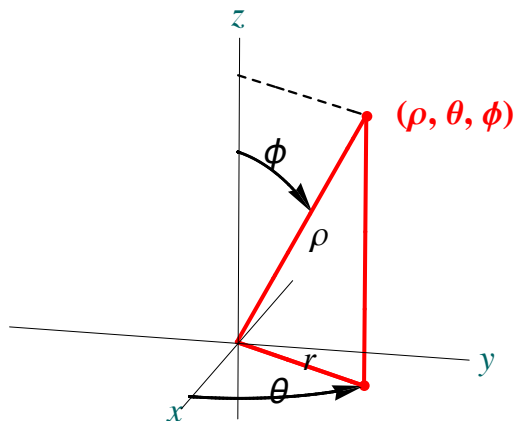
Spherical Coordinates

Spherical coordinates are written (ρ, θ, ϕ) , and the conversion to rectangular coordinates (x, y, z) is

$$x = \rho \sin(\phi) \cos(\theta) \quad y = \rho \sin(\phi) \sin(\theta) \quad z = \rho \cos(\phi)$$

Converting from rectangular to cylindrical use

$$\rho^2 = x^2 + y^2 + z^2$$



Example 4 Find the rectangular coordinates for the spherical point $(4, \frac{\pi}{3}, \frac{3\pi}{4})$.

Example 5 Identify the surface given by $\rho \sin(\phi) = 2$